

CESTODE PARASITES OF SOME VENEZUELAN STINGRAYS

Monte A. Mayes and Daniel R. Brooks

Abstract.—Forty-seven stingrays representing 8 species collected in Venezuelan coastal waters were examined for cestode parasites. Specimens of 18 tetraphyllidean, lecanicephalidean, and trypanorhynchan cestode species were collected, 3 described as new. *Rhinebothrium margaritense* sp. n. from *Dasyatis guttata* and *D. americana* most closely resembles *R. spinicephalum* and *R. tetralobatum* but differs by having 3-6 rather than only 2 testes per proglottid and a different number of bothridial loculi. *Rhodobothrium paucitesticulare* sp. n. from *Rhinoptera bonasus* possesses fewer than half as many testes per proglottid as any other known member of the genus. *Dioecotaenia campbelli* sp. n. differs from *D. cancellata* by having 24 rather than 21 bothridial loculi and smaller eggs and embryos. Other collected species include: *Acanthobothrium electricolum* in *Narcine brasiliensis*, *A. fogeli* in *Gymnura micrura*, *Disculiceps* sp. and *Acanthobothrium tortum* in *Aetobatus narinari*, *Tylocephalum* sp. and *Rhinoptericola megacantha* in *Rhinoptera bonasus*, *Rhinebothrium magniphallum* and *Parachristianella* cf. *monomegacantha* in *Himantura schmardae*, *Acanthobothrium americanum*, *Phyllobothrium centrurum*. *Rhinebothrium corymbum* and *Rhodobothrium pulvinatum* in *Dasyatis americana*, and *Acanthobothroides thorsoni*, *Acanthobothrium tasajerasi*, *A. urotrygoni*, *Rhinebothrium magniphallum*, and *Rhodobothrium pulvinatum* in *Dasyatis guttata*. All represent new locality records, and those species occurring in *Dasyatis guttata* are reported from that host for the first time.

Little is known about the helminth fauna of elasmobranchs living along the Venezuelan coast. Troncy (1969) described a nematode, *Echinocephalus diazi*, from Lake Maracaibo and listed the freshwater stingray *Potamotrygon hystrix* as host. Later, Diaz-Ungria (1973) corrected the host identification to the euryhaline dasyatid stingray *Himantura schmardae* (Werner). Deardorff, Brooks, and Thorson (in press) discovered *E. diazi* in *H. schmardae* from Colombia, thus confirming Diaz-Ungria's statement. We found no other reports of helminths infecting Venezuelan coastal stingrays.

This paper reports 18 species of tetraphyllidean, lecanicephalidean and trypanorhynchan cestodes collected by the first author during examinations of 47 stingrays representing 8 species. Stingrays were collected during the summer from the Gulf of Venezuela and from Lake Maracaibo (1977 and 1978) and from Isla de Margarita (1978). Table 1 summarizes our findings.

Helminths were removed from hosts, examined alive when possible, fixed with AFA or 10% formalin and stored in 70% ethanol. Most specimens were stained with Mayer's hematoxylin and mounted in Canada balsam for study as whole mounts. Serial cross sections, cut at 8 μm and stained with hematoxylin-eosin, were used to confirm some aspects of proglottid morphology. All measurements are in μm unless otherwise stated; figures were drawn with the aid of a drawing tube. Representative specimens of all species have been deposited in the University of Nebraska State Museum, Division of Parasitology, Harold W. Manter Laboratory.

Rhinebothrium margaritense, sp. nov.

Figs. 1-2

Description (based on 15 specimens).—Strobila up to 5.7 mm long, craspedote, apolytic, composed of 75-100 proglottids. Scolex up to 1.86 mm wide, composed of 4 pedicellated, elongate, bilobed, septate bothridia. Bothridia 744-1,209 long by 232-279 wide; divided longitudinally by median septum, horizontally by hingelike constriction between lobes; posterior lobe divided horizontally by 12-13 septa forming 26-28 loculi; anterior lobe divided horizontally by 12 septa forming 26 loculi plus terminal loculus at tip; total number of loculi per bothridium 53 or 55. Pedicels 418-558 long. Cephalic peduncle short, aspinose, 46-93 long. Immature proglottids wider than long. Mature proglottids 120-456 long by 182-240 wide, length greater than width only in last 6-10 proglottids if at all. Genital pore 48-52% (\bar{x} = 50%, n = 50) of proglottid length from anterior end. Testes 3-6 (\bar{x} = 4, n = 68) in number, 20-60 in diameter. Cirrus sac elongate, 84-120 long by 36-72 wide, containing spined eversible cirrus. Genital atrium shallow, simple. Vagina anterior to cirrus sac, sphincter present. Ovary X-shaped in cross section, bilobed in frontal view, lobate, poral lobe extending anteriorly to level of genital pore; 65-156 long by 50-165 wide at isthmus. Vitellaria follicular; follicles 3-7 in diameter, extending nearly entire length of proglottid. Gravid proglottids not collected.

Hosts.—*Dasyatis guttata* (Bloch and Schneider) (type); *Dasyatis americana* Hildebrand and Schroeder.

Site of infection.—Spiral valve.

Locality.—Isla de Margarita, near Robledal, Venezuela.

Holotype.—USNM Helm. Coll. No. 75715. Paratypes: USNM Helm. Coll. No. 75716; Univ. Nebraska State Museum No. 21036.

Etymology.—This species is named for the island from which it was collected.

Remarks.—*Rhinebothrium margaritense* is a member of a monophyletic species-group within *Rhinebothrium* characterized by being small worms with relatively to markedly long bothridial pedicels, more than 25 proglottids

Table 1.—Host-parasite list for cestodes collected in Venezuelan coastal waters during 1978 and 1979. All previously known species are reported from Venezuela for the first time. * = new host record.

Host	Cestode species	Locality and incidence
<i>Narcine brasiliensis</i> (Olfers)	<i>Acanthobothrium electricolum</i> Brooks and Mayes, 1978	Robledal, Isla de Margarita (1/3)
<i>Rhinobatos percellens</i> (Walbaum)	Negative	Isla de Margarita (2)
<i>Aetobatus narinari</i> (Euphrasen)	<i>Acanthobothrium tortum</i> Linton, 1890 <i>Disculiceps</i> sp.	Gulf of Venezuela, Caimáre Chico (1/1) same
<i>Gymnura micrura</i> (Bloch and Schneider)	<i>Acanthobothrium fogeli</i> Goldstein, 1964	Isla de Margarita (1/2)
<i>Rhinoptera bonasus</i> (Mitchill)	<i>Rhinoptericola megacantha</i> Campbell and Carvajal, 1975 <i>Rhodobothrium paucitesticulare</i> sp. n. <i>Dioecotaenia campbelli</i> sp. n. <i>Tylocephalum</i> sp.	Gulf of Venezuela, Caimáre Chico (1/9) same same same
<i>Himantura schmardae</i> (Werner)	<i>Parachristianella</i> cf. <i>monomegacantha</i> <i>Rhinebothrium magniphallum</i> Brooks, 1977	Boca Cañonero, Bahía de Tablazo, Lake Maracaibo (1/2) same
<i>Dasyatis americana</i> Hildebrand and Schroeder	<i>Phyllobothrium centrurum</i> Southwell, 1925 <i>Rhodobothrium pulvinatum</i> Linton, 1889 <i>Rhinebothrium corymbum</i> Campbell, 1975 <i>Rhinebothrium margaritense</i> sp. n. <i>Acanthobothrium americanum</i> Campbell, 1969	Isla de Margarita (3/3) same (2/3) same (1/3) same (2/3) same (2/3)
<i>Dasyatis guttata</i> (Bloch and Schneider)	<i>Rhodobothrium pulvinatum</i> * Linton, 1889 <i>Rhinebothrium magniphallum</i> * <i>Rhinebothrium margaritense</i> sp. n.	Gueria, Gulf of Paria (1/3) Mouth of Lake Maracaibo (1/9) El Guano, S. of Rio Apon, Lake Maracaibo (1/5) Robledal, Isla de Margarita (1/2)

Table 1.—Continued.

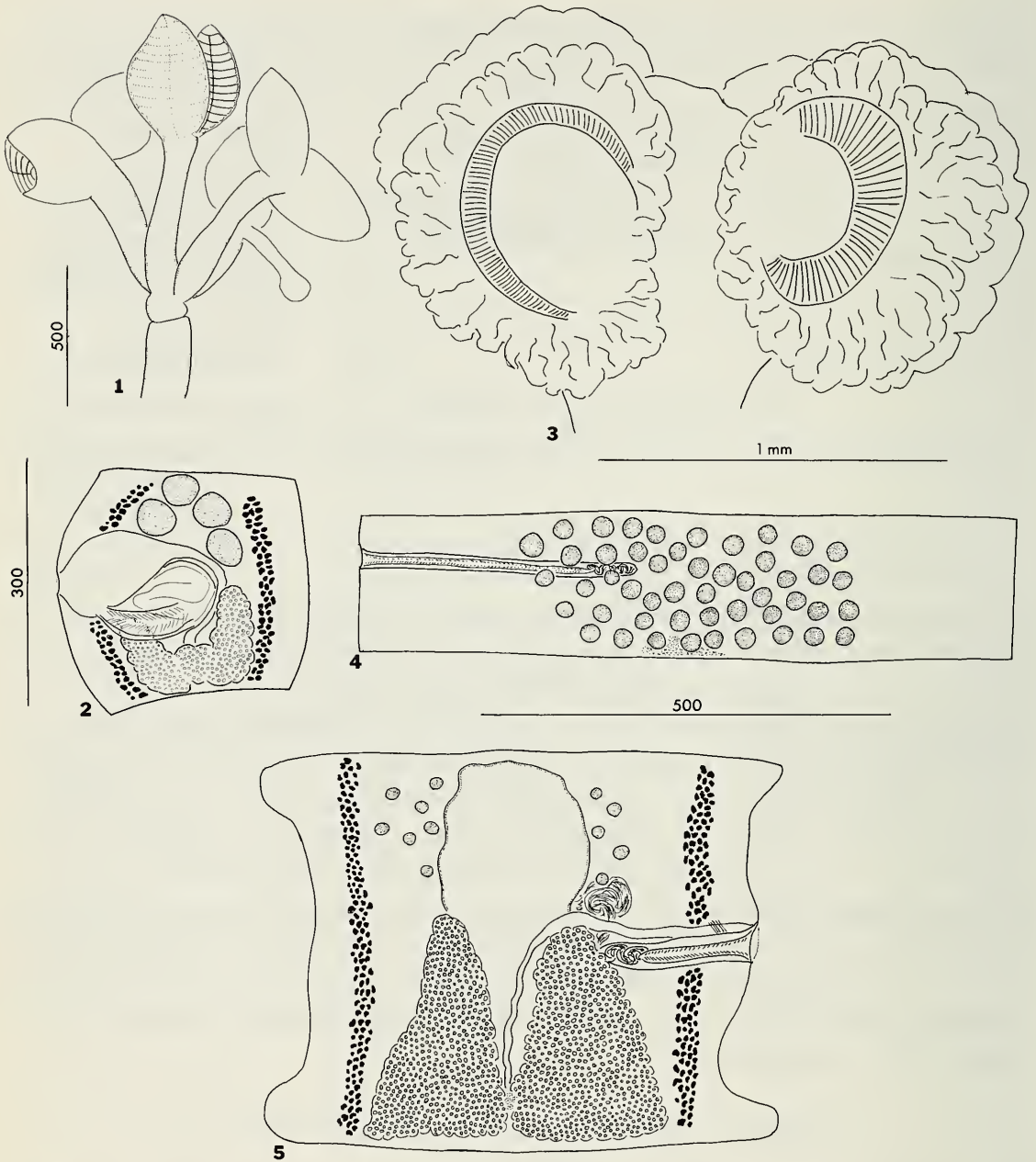
Host	Cestode species	Locality and incidence
	<i>Acanthobothroides thorsoni</i> * Brooks, 1977	Robledal, Isla de Margarita (1/2)
	<i>Acanthobothrium urotrygoni</i> * Brooks and Mayes, 1980	Gulf of Venezuela, Caimáre Chico (1/5) Mouth of Lake Maracaibo (1/9) Robledal, Isla de Margarita (1/2)
	<i>Acanthobothrium tasajerasi</i> Brooks, 1977	Mouth of Lake Maracaibo (1/9)

per strobila, craspedote proglottids which are wider than long except for terminal proglottids, bilobed bothridia with a single median septum and at least 32 loculi, and an average of fewer than 10 testes per proglottid. The genealogical relationships of that species-group's members have been presented elsewhere (Brooks, Mayes, and Thorson, in press). The new species most closely resembles *R. spinicephalum* Campbell, 1969 and *R. tetralobatum* Brooks, 1977 both of which possess 2 testes per proglottid rather than 3–6 ($\bar{x} = 4$) exhibited by *R. margaritense*. *Rhinebothrium spinicephalum* further differs from the new species by possessing 32–34 bothridial loculi rather than 53 or 55 as exhibited by *R. margaritense*; *R. tetralobatum* possesses 48–54 loculi. Both *R. spinicephalum* and *R. margaritense* possess compact lobate ovaries, differing from the fragmented 4-part ovaries of specimens of *R. tetralobatum*.

Rhodobothrium paucitesticulare, sp. nov.

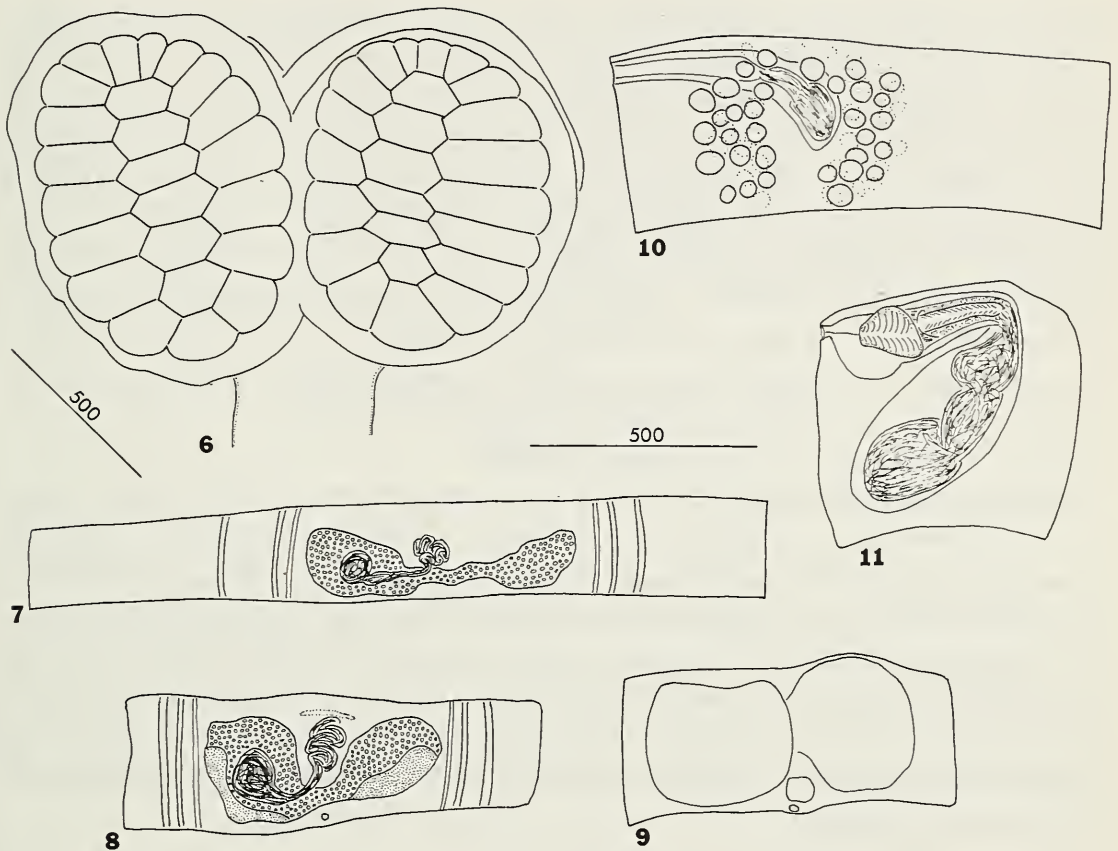
Figs. 3–5

Description (based on 7 specimens).—Tetraphyllidea, Phyllobothriidae, *Rhodobothrium* Linton, 1890 as emended by Campbell and Carvajal, 1979. Strobila craspedote, serrate posteriorly, maximum dimensions 20–31 mm long by 7.4–9.0 mm wide. Scolex 1.0–1.9 mm wide, composed of 4 pedicellated bothridia. Bothridia 465–930 long by 465–930 wide, trumpet-shaped when relaxed, adherent surfaces convex, traversed by numerous convolutions forming irregular pattern. Bothridial faces round or subtriangular in cross section, margins ruffled. Pedicels approximately 250 long. Neck up to 1.86 mm long by 700 wide. Number of segments 400–600. Immature proglottids wider than long, markedly protandric. Mature proglottids squared,



Figs. 1-5. *Rhinebothrium margaritense*: 1, Scolex; 2, Mature proglottid. *Rhodobothrium paucitesticulare*: 3, Scolex; 4, Immature proglottid; 5, Mature proglottid.

372-651 long by 372-605 wide. Genital pore alternating irregularly in anterior 48-52% (\bar{x} = 50%, n = 25) of proglottid; genital atrium well-developed. Cirrus sac 186-279 long by 93-140 wide, containing spined eversible cirrus. Testes 40-80 in number (\bar{x} = 50, n = 100) in immature proglottids; few senescent testes present or testes lacking in mature proglottids. Testes subspherical, 24-60 in diameter. Vagina anterior to cirrus sac, sphincter pres-



Figs. 6–11. *Dioecotaenia campbelli*: 6, Scolex; 7, Early mature female proglottid; 8, Mature female proglottid; 9, Gravid female proglottid; 10, Maturing male proglottid; 11, Fully mature male proglottid ready for hypodermic insemination following detachment.

ent. Ovary follicular, bilobed in frontal view, X-shaped in cross section; lobes expanded anteriorly in maturing proglottids, 167–353 long by 373–465 at isthmus. Vitellaria forming lateral bands extending nearly entire length of proglottid; follicles 24–120 in diameter. Uterus saccate, preovarian in mature proglottids. Gravid proglottids not collected.

Host.—*Rhinoptera bonasus* (Mitchill).

Site of infection.—Spiral valve.

Locality.—Gulf of Venezuela, Caimáre Chico, Venezuela.

Holotype.—USNM Helm. Coll. No. 75717. Paratypes: USNM Helm. Coll. No. 75718; Univ. Nebraska State Museum No. 21034.

Etymology.—The specific name refers to the presence in this species of only about half as many testes per proglottid as are present in members of the other known species.

Remarks.—Campbell and Carvajal (1979) reviewed *Rhodobothrium* Linton, 1889, recognizing it as the senior synonym of *Inermiphyllidium* Riser,

1955 and *Sphaerobothrium* Euzet, 1959. They considered *R. pulvinatum* Linton, 1889, *R. lubeti* (Euzet, 1959) Campbell and Carvajal, 1979, and *R. mesodesmatum* (Bahamonde and Lopez, 1962) Campbell and Carvajal, 1979 members of *Rhodobothrium* and *R. brachyascum* (Riser, 1955) Campbell and Carvajal, 1979 a provisional member of the genus. The new species differs from the above by exhibiting approximately half as many testes per proglottid, 40–80 with a mean of 50 vs. 117–149, 120–160, and 150–210, respectively for the 3 species listed above. *Rhodobothrium paucitesticulare* further differs by being more markedly protandric. No evidence beyond ovarian anlagen indicates female genitalia in proglottids containing fully developed testes. The testes senesce markedly in proglottids containing developing ovaries and other female genitalia.

Such an observed ontogenetic feature is of potential interest when hosts for *Rhodobothrium* species are compared. *Rhodobothrium lubeti* and *R. mesodesmatum* infect *Myliobatis* spp., *R. pulvinatum* infects members of *Dasyatis*, and the new species infects *Rhinoptera bonasus*. *Rhinoptera bonasus* already is known to host the only dioecious tetraphyllidean cestode (we describe another species from the same host next), raising the possibility that the presence of a markedly protandric species of tetraphyllidean in *R. bonasus* relates more to a more general phenomenon involving some aspect of the host's biology.

Dioecotaenia Schmidt, 1969

Schmidt (1969) redescribed *Rhinebothrium cancellatum* Linton, 1890 and reported it to be a dioecious cestode, the only known such tetraphyllidean. His generic diagnosis was so extensive that a second new species which we describe herein could not be accommodated within the genus unless we emended Schmidt's (1969) diagnosis slightly, as follows:

Emended diagnosis.—Tetraphyllidea, Dioecotaeniidae. Sexes completely separate. Sexual dimorphism apparent. Scolex with 4 bothridia on short peduncles, each divided into loculi interpretable as 3 longitudinal rows of equal numbers of loculi or a center row of loculi surrounded by a circle of marginal loculi. Myzorhynchus, accessory suckers, and hooks lacking. Neck present. External segmentation feeble, proglottids acraspedote. Osmoregulatory canals consisting of 6 major medullary trunks, of which the most lateral are highly ramified and anastomose with irregular ducts leading to lateral margins. Cortex thin. Muscle bundles feeble.

Testes medullary, in 2 layers, arranged in a semicircle or circle on all sides of cirrus sac. Genital pores lateral, alternating irregularly. Cirrus sac large, containing spined eversible cirrus and internal seminal vesicle. Cirrus long, armed at base with hooks possessing bifid roots. External seminal vesicle lacking.

Ovary bilobed, transversely elongate, medullary. Oviduct short. Vagina medullary, convoluted; vaginal pore lacking. Seminal receptacle embedded in substance of one ovarian lobe, irregularly alternating sides. Vitellaria compact, surrounding posterolateral margins of both ovarian lobes. Uterus bilobed, saccate, preovarian. Uterine pore preformed, medioventral. Embryo with simple outer membrane. Sperm transfer by hypodermic impregnation. Medullary continuous dorsomedian sheath containing injected cirri present in female. Parasites of elasmobranchs. Type-species: *D. cancellata* (Linton, 1890) Schmidt, 1969. Other species:

Dioecotaenia campbelli, sp. nov.

Figs. 6–11

Description (based on 15 specimens).—With characters of the genus given above.

Males (7 specimens): Strobila up to 26 mm long by 1.21–1.73 mm wide. Scolex 962–979 long by 1,270–1,490 wide. Bothridia 790–1,023 long by 651–698 wide, possessing 24 loculi arranged either as 3 longitudinal rows of 8 loculi or as a median row of 6 loculi surrounded by 18 marginal loculi. Neck approximately 5 mm long. Strobila with up to 200 proglottids. Testes 60–90 in number (\bar{x} = 80, n = 20), 19–36 in diameter. Testes atrophy markedly in posteriormost proglottids as internal seminal vesicle and cirrus sac enlarge. Cirrus sac curved posteriorly, more markedly in older proglottids; sac 279–623 long by 47–139 wide. Genital atrium prominent, capable of protruding as suckerlike papilla, surrounded by darkly-staining parenchymal cells.

Female (8 specimens): Strobila up to 50 mm long by up to 1.9 mm wide. Scolex 962–974 long by 1,270–1,490 wide. Bothridia and neck as in male. Strobila with up to 200 proglottids. Ovary 139–279 long by 465–605 wide. Seminal receptacle 93–139 in diameter. Uterus first a transverse sac, becoming bilobed when gravid, with thin ventral isthmus. Uterine pore near posterior end of proglottid. Eggs 45–65 in diameter, oncospheres 36–48 in diameter.

Host.—*Rhinoptera bonasus*.

Site of infection.—Spiral valve.

Locality.—Gulf of Venezuela, Caimáre Chico, Venezuela.

Holotype.—USNM Helm. Coll. No. 75719 (male). Allotype: USNM Helm. Coll. No. 75720 (female). Paratypes: USNM Helm. Coll. No. 75721; Univ. Nebraska State Museum No. 21033.

Etymology.—This species is named for Dr. Ronald A. Campbell, Southeastern Massachusetts University, in recognition of his contributions to the systematics of cestodes infecting elasmobranchs.

Remarks.—*Dioecotaenia campbelli* closely resembles *D. cancellata*, the only consistent anatomical differences being number of bothridial loculi (24

in the new species vs. 21 in *D. cancellata*) and size of eggs and embryos (36–48 μm in diameter eggs vs. 45–65 μm in diameter eggs; 19–26 μm in diameter oncospheres vs. about 35 μm in diameter oncospheres). Because both species inhabit the same host species and occur in adjacent geographical areas, it seems likely that they are sister-species. Thus, their close morphological similarity does not necessarily indicate any degree of morphological conservatism in *Dioecotaenia*.

Literature Cited

- Brooks, D. R., M. A. Mayes, and T. B. Thorson. In press. Systematic review of cestode infecting freshwater stingrays (Chondrichthyes: Potamotrygonidae) including four new species from Venezuela.—*Proc. Helm. Soc. Wash.*
- Campbell, R. A., and J. Carvajal G. 1979. Synonymy of the phyllobothriid genera *Rhodobothrium* Linton, 1889, *Inermiphylidium* Riser, 1955, and *Sphaerobothrium* Euzet, 1959 (Cestoda: Tetrphyllidea).—*Proc. Helm. Soc. Wash.* 46:88–97.
- Deardorff, T. L., D. R. Brooks, and T. B. Thorson. In press. Two species of *Echinocephalus* (Nematoda: Gnathostomidae) from Neotropical stingrays.—*J. Parasitol.*
- Diaz-Ungria, C. 1973. Helintos endoparasitos de Venezuela.—*Cien. Vet., Maracaibo* 3:37–242.
- Schmidt, G. D. 1969. *Dioecotaenia cancellata* (Linton, 1890) gen. et comb. n., a dioecious cestode (Tetrphyllidea) from the Cow-Nosed Ray, *Rhinoptera bonasus* (Mitchill), in Chesapeake Bay, with the proposal of a new family, Dioecotaeniidae.—*J. Parasitol.* 55:271–275.
- Troncy, P. M. 1969. Description de deux nouvelles espèces de nematodes parasites de poissons.—*Bull. Mus. Natn. Hist. Nat.* 2nd series 41:598–605.

(MAM) Environmental Sciences Research, 1702 Building, Dow Chemical USA, Midland, Michigan 48640; (DRB) Department of Pathology, National Zoological Park, Smithsonian Institution, Washington, D.C. 20008 (present address: Department of Zoology, University of British Columbia, 2075 Westbrook Mall, Vancouver, British Columbia, Canada V6T 1W5).